63rd EAAP meeting

Slovak Technical University, Bratislava, Slovakia, August 27-31, 2012

S.39 Management and health: business meeting and free communications

Transfer of trace elements from feed to pig tissues: management of feed and food limits

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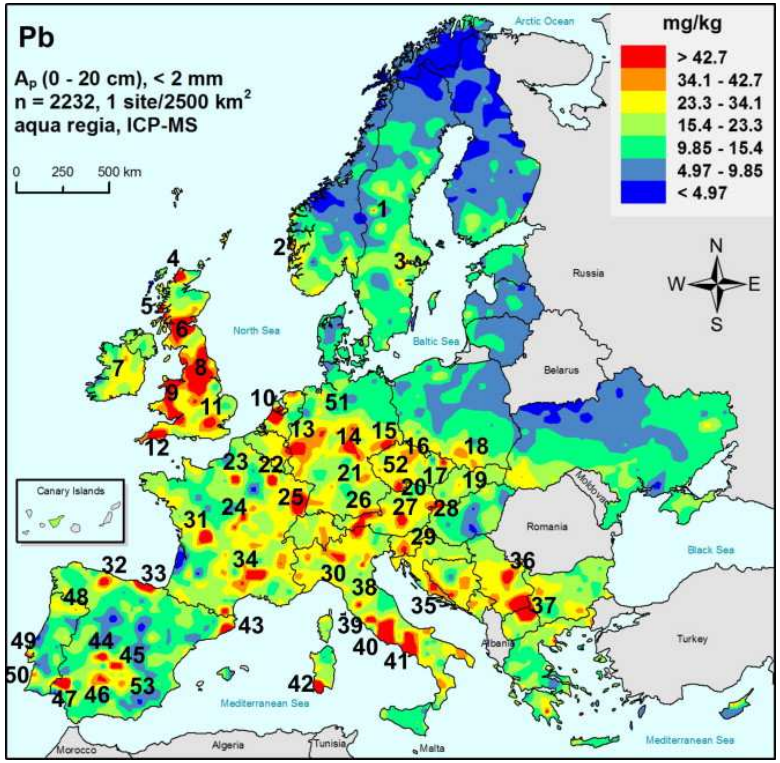
Ifip-institut du porc, France

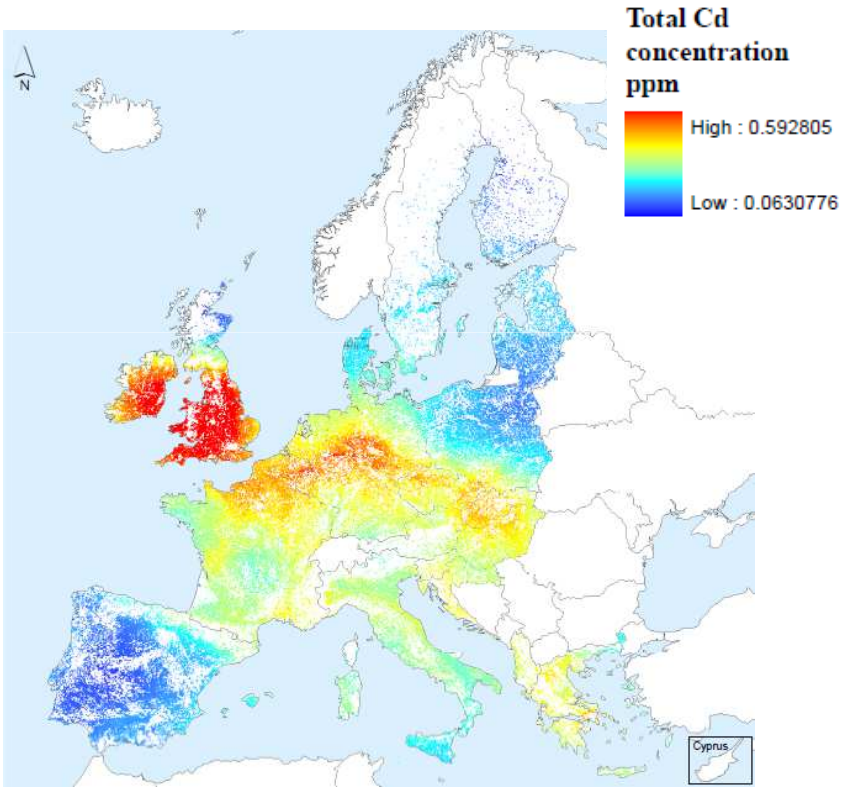
Trace elements in agricultural soils

Pb concentration



Clemens Reimann et al,
Applied Geochemistry, 27, 3, 2012

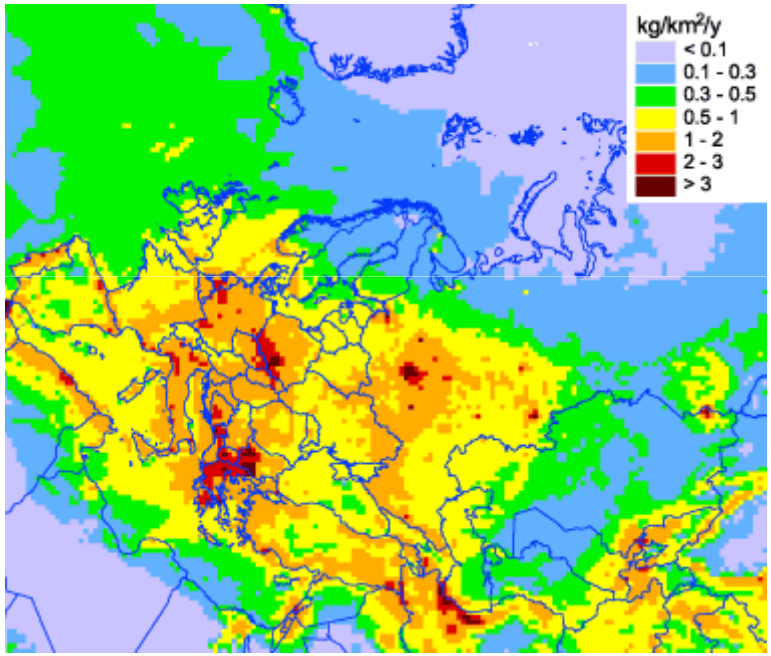
Cd concentration



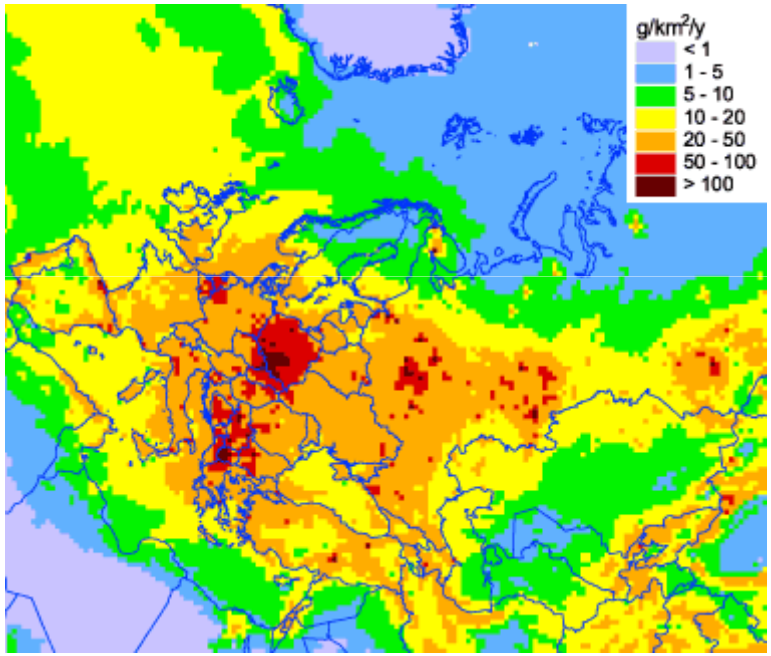
Report on the project 'Sustainable Agriculture and Soil Conservation (SoCo)'
http://eusoils.jrc.ec.europa.eu/ESDB_Archive/eusoils_docs/other/EUR23767_Final.pdf

Total (dry and wet) deposition of Pb and Cd in 2009

- Pb deposition



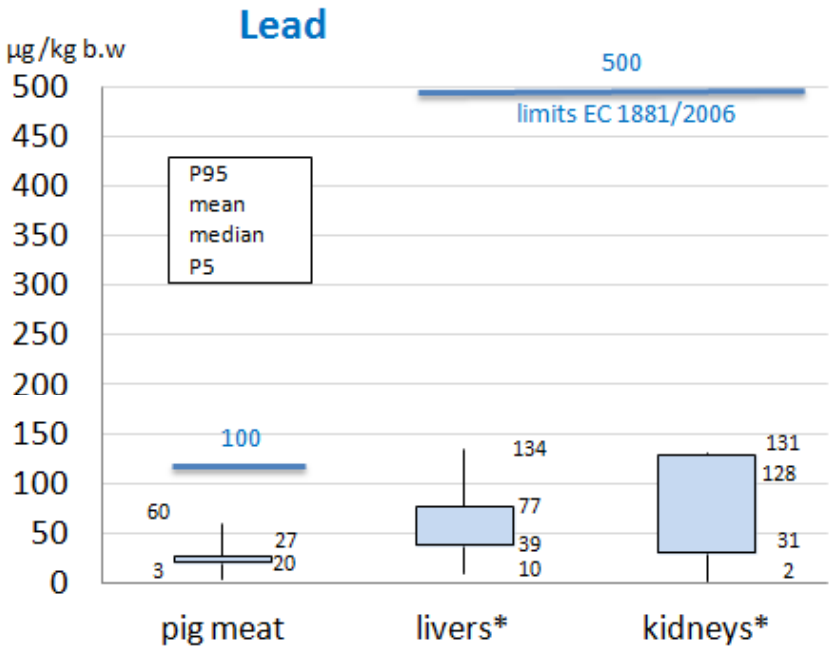
- Cd deposition

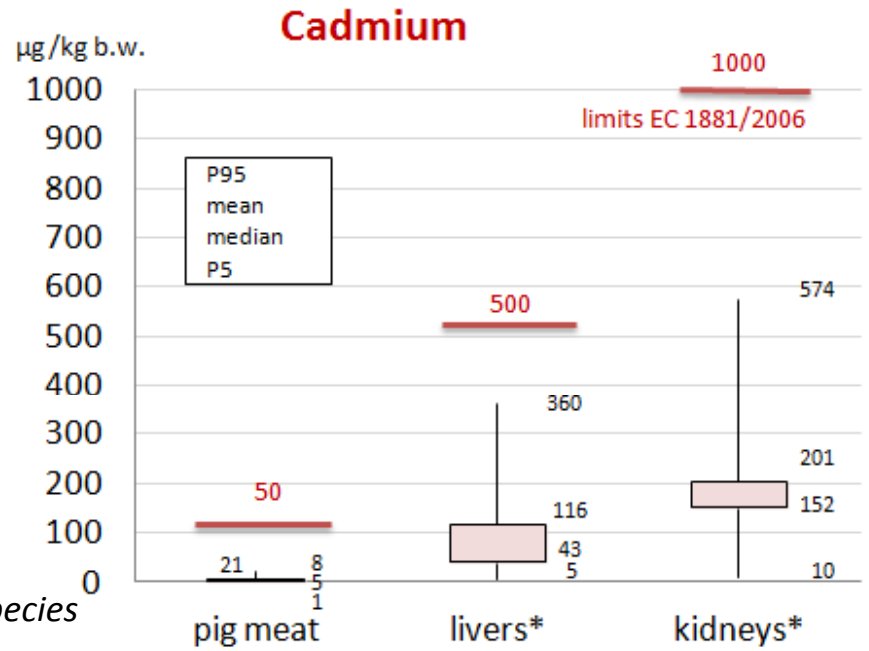


EMEP data (Co-operative programme for monitoring and evaluation of the long-range transmissions of air pollutants in Europe)
http://www.msceast.org/index.php?option=com_content&view=article&id=88&Itemid=29)

Pb and Cd occurrence in EU

pig meat and edible offals (from Efsa, 2009, 2010)

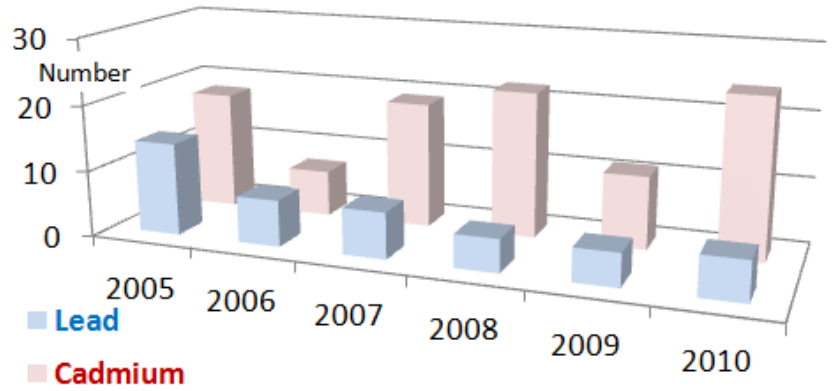




*all species

non-compliant samples in pigs

from EC, 4000 to 5000 targeted samples per year



Background and aims of the study

- **regulations**
  - different methods to calculate maximal levels in feed- and foodstuffs
    - animal feeding (Directive 2002/32 of Parliament & Council)
    - food (Regulation 1881/2006 of Commission)
- **few studies with low exposure levels**
  - toxicological studies : levels ≥ tolerance levels
  - interactions with protein, Cu,... Contents
- **experimental study in pigs**
  - low dietary doses Cd & Pb → food products

Experimental design

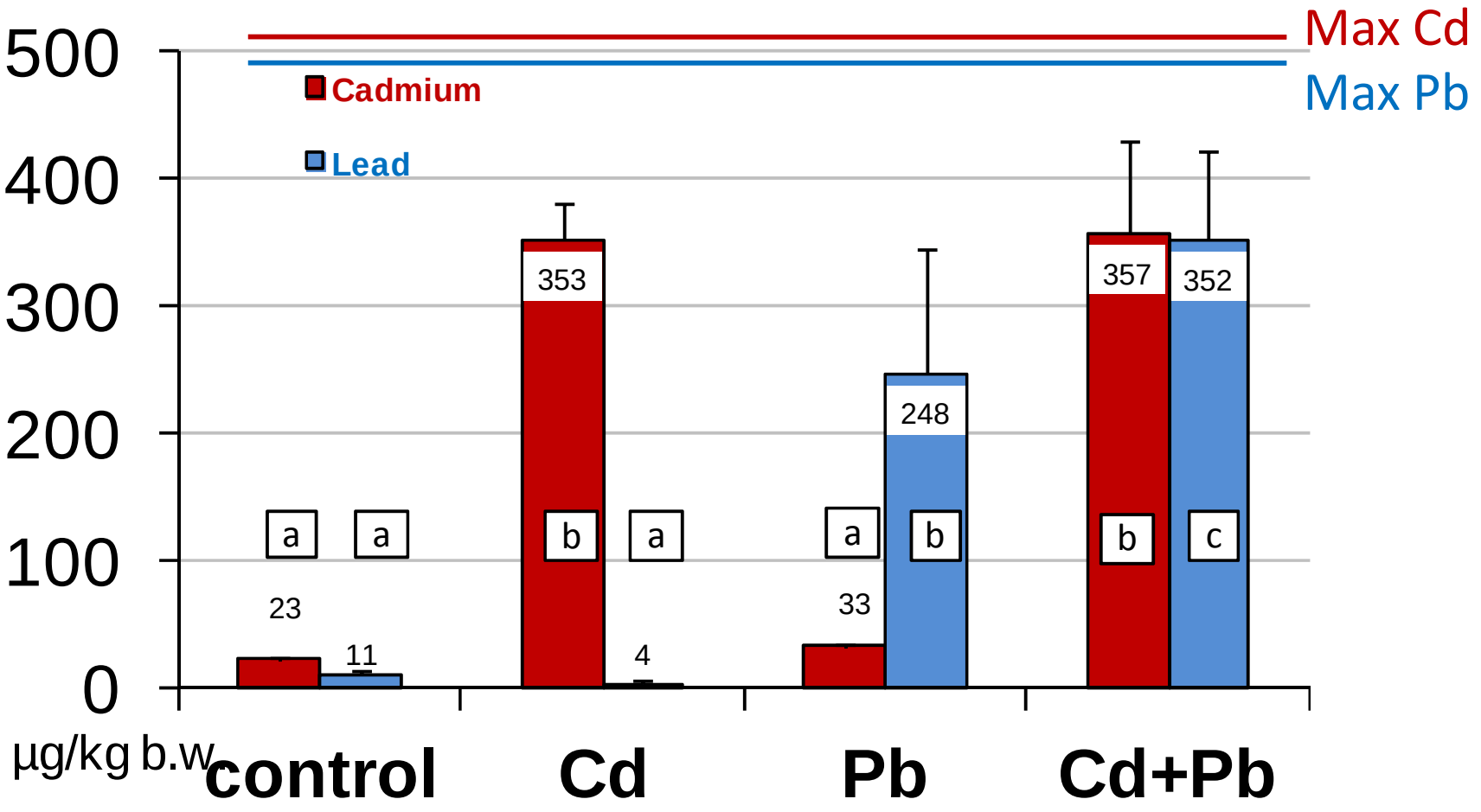
- **long term dietary exposure to Cd / Pb**
  - post weaning to slaughtering (119 days)
  - standard diets and rearing conditions
- **exp.1**
  - control vs < 0.5 mg Cd /kg, < 5 mg Pb /kg (maximal limits in complete feeds for pigs)

	control	Cd	Pb	Cd+Pb
Cd	-	+	-	+
Pb	-	-	+	+

- **exp.2**
  - control vs < 0.5 mg Cd /kg

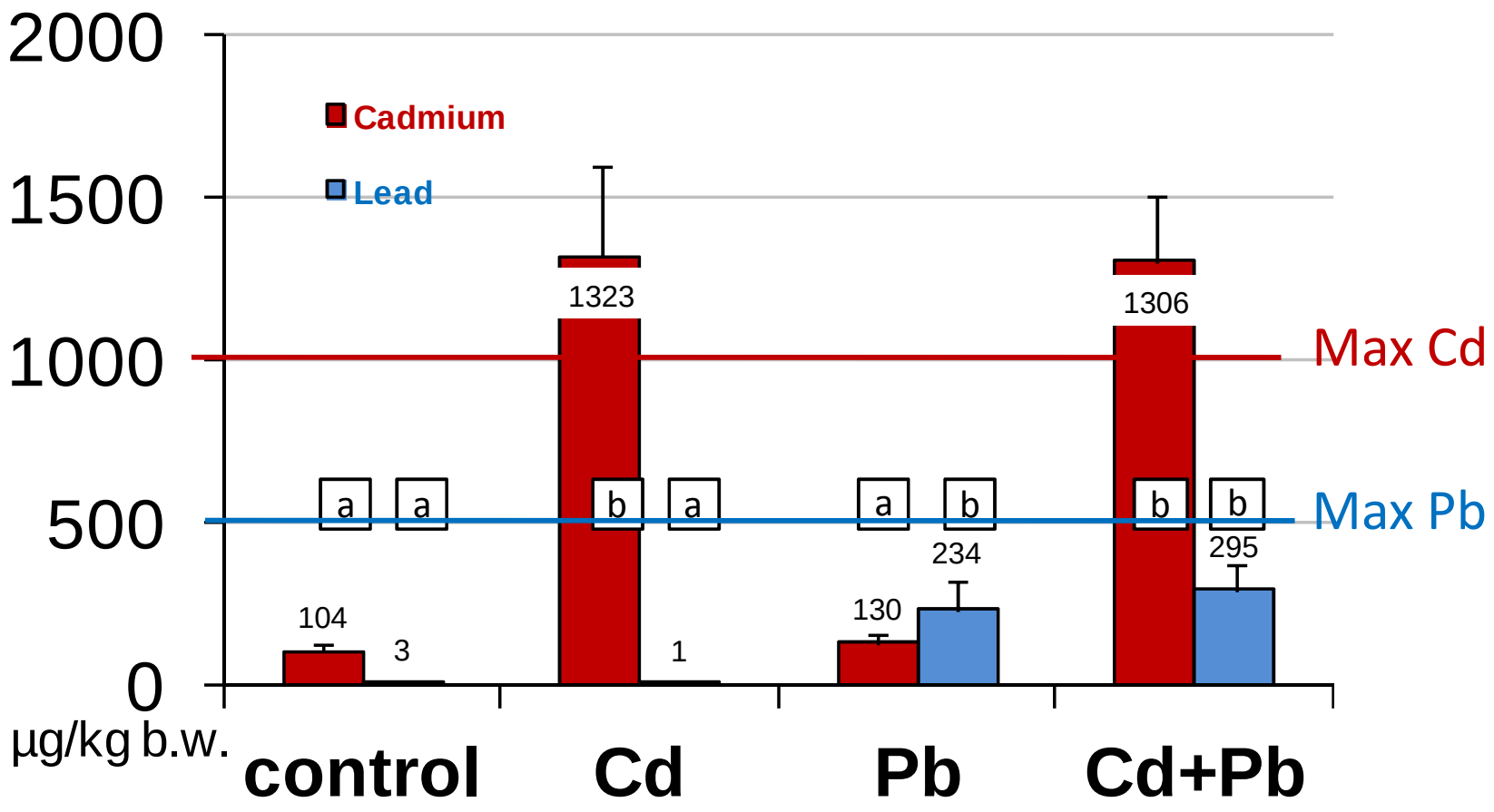
	control	Cdmin	Cdveg	Cdstop
Cd	-	+	+	+/-

Results Exp.1 : concentrations in liver



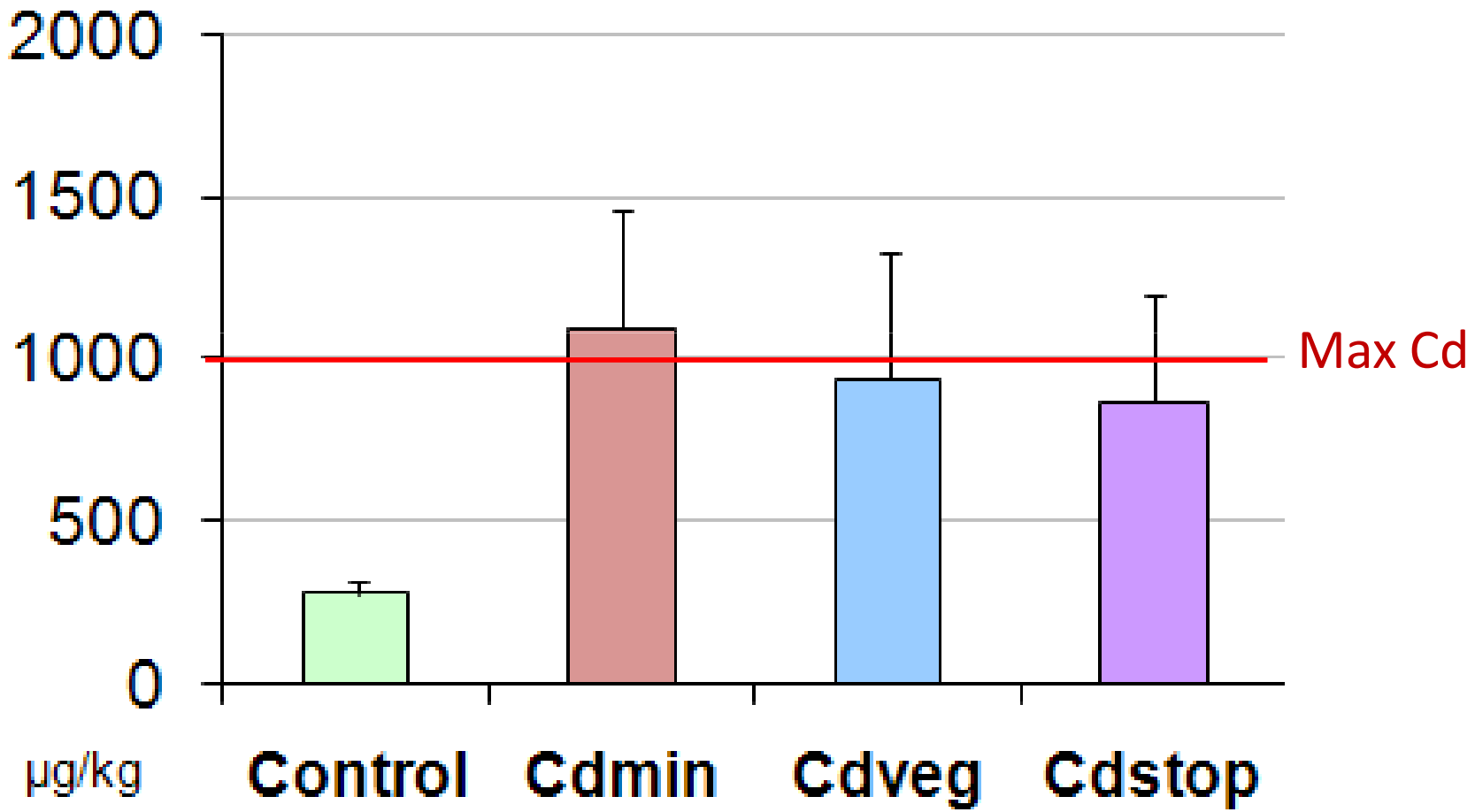
Royer et Lebas, 2010

Results Exp.1 : levels in kidneys



Royer et Lebas, 2010

Results Exp.2 : concentrations in kidney



Royer et Lebas, 2010

Results : concentrations in *semimembranosus* muscle

- **Exp. 1**

µg / kg total product	control	Cd	Pb	Cd+Pb
Cadmium	< 5	< 5	< 5	< 5
Lead	< 1	-	< 1	< 1

- **Exp. 2**

µg / kg total product	control	Cdmin	Cdveg	Cdstop
Cadmium	< 1	< 1	< 1	< 1

– Regulatory limits
- Pb = 100 µg/kg total product
- Cd = 50 µg/kg total product

Royer et Lebas, 2010

Implications

- **long term & low level exposure of pigs**
  - exposed pigs
    - low levels in meat
    - no excess for Pb and liver (Cd)
    - but ...slight excess for Cd level in kidney
  - [livers & kidneys] = f(feeds)
    - [Pb] > Phillips et al, 2003
    - Rambeck et al, 1991 > [Cd] ≅ Rothe et al, 1994, Linden, 2002 > Phillips et al, 2003
- **management of feed and food limits**
  - …compliance to a feed limit does not mean that animal products are not above the food limits….
    - ALARA vs. Tolerable Weekly Intake approaches
    - Modeling Cd accumulation in sheep , eggs, milk ..[Prankel et al, 2005, van Eijkeren et al, 2006; van Raamsdonk et al, 2009]

new fact: more need to reduce Cd exposure !

- **Tolerable Weekly Intake**
  - Joint FAO/WHO Expert Committee on Food Additives (JECFA):
    - 1988: 7 µg/kg body weight
    - 2010: 5.8 µg/kg body weight
  - EFSA Panel on Contaminants in the Food Chain:
    - 2009-2011: 2.5 µg/kg body weight
    - *"ensure a high level of protection of all consumers, including exposed and vulnerable subgroups of the population"*
- **Average Cd dietary exposure for the European population:**
  - EFSA Scientific report
    - 2012: 2.04 µg/kg body weight per week.

EU Commission's review of Cd maximum levels

- Questions
  - which possibilities to reduce Cd exposure of general population and specific vulnerable groups (children, vegetarians)?
  - room for reduction of maximum levels for foodstuffs that contribute mostly to exposure (e.g. cereals and cereal products, vegetables nuts and pulses group, edible offals, starchy roots and potatoes?)
  - need to set new maximum levels for food commodities? If so, for which?

- Working document...
  - Proposal at inter-services scrutiny (other DG) in 2012
  - Some concerns from different Member States...
  - First discussions of Standing Committee about cocoa/chocolate, oilseeds, potatoes, wheat, milk, ...

THE EUROPEAN COMMISSION

'3.2	**Cadmium**	**Maximum levels (mg/kg wet weight)**	
3.2.1	**Raw milk[(6)], heat-treated milk and milk for the manufacture of milk-based products**	**0,005**	**To be discussed whether this ML is needed. Important exposure for children, but low levels.**
3.2.2	Meat (excluding offal) of bovine animals, sheep, pig and poultry[(6)]	0,050	No change
3.2.3	Horsemeat, excluding offal[(6)]	0,20	No change
3.2.4	Liver of bovine animals, sheep, pig, poultry and horse[(6)]	**0,30**	Significant exposure according to new data, reduction possible on basis of occurrence data.
3.2.5	Kidney of bovine animals, sheep, pig, poultry and horse[(6)]	**0,80**	Significant exposure according to new data, reduction possible on basis of occurrence data.

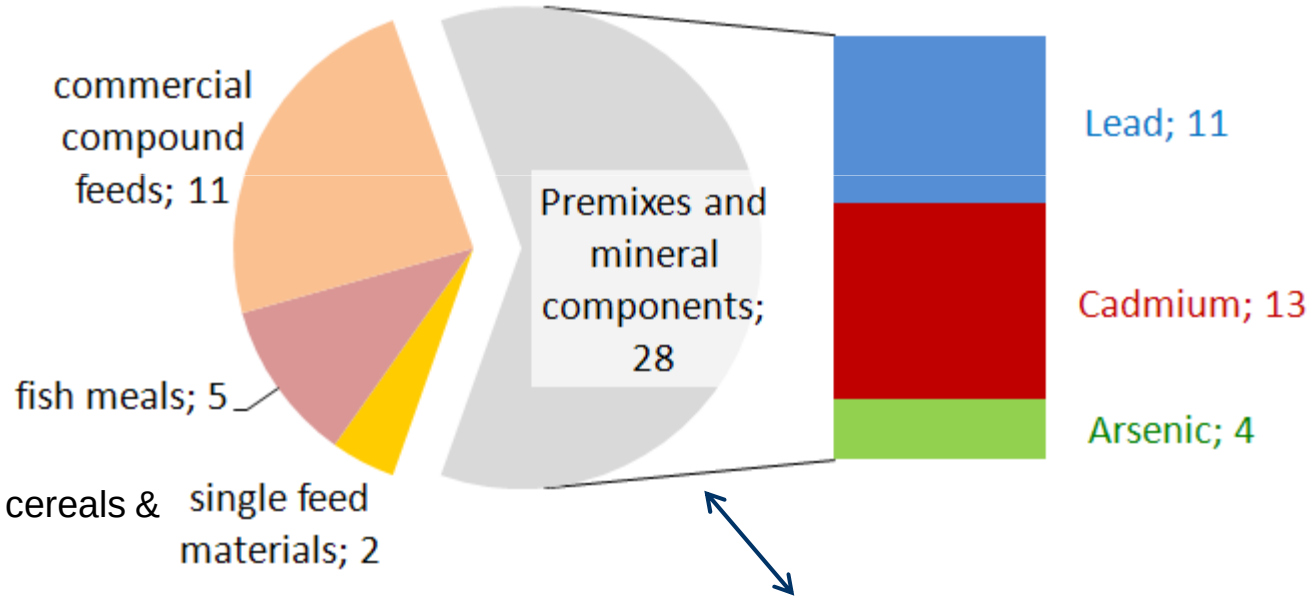
WORKING DOCUMENT

Cd exposure of pigs: what can we do ?

- Dietary exposure period
  - accumulation pattern
    - poor effect of contaminated diet removal (Exp.2)
    - equivalence of mineral and crop origin of Cd (Exp.2)
    - effect of animal age ?
- Diets composition and bioavailibility
  - role of diet composition
    - copper, phytase enzyme, vitamin C (Exp.3 in progress)
- Feed ingredients safety
  - raw materials, minerals

Origin of metal contamination in animal feeds

- 45 notifications to the Rapid Alert System for Feed and Food (RASFF – 2000-2009)



Origin:
- EU : 11
- Third countries : 17

Conclusions

- **Feed and food safety issues**
  - respecting feed limits does not imply compliance of food limits
  - continuous exposure < max levels in diets → $[Cd]_{kidney}$ > tolerances
  - role of feeding practices
  - information of feed manufacturers about origin of mineral feedstuffs
  - pork products
    - monitoring of offal's
    - monitoring → information of industry....

Acknowledgments

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Thank you for your attention